Exchange Rate Exposure of Swedish Banks

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Abstract

This thesis examines the exchange rate exposure of the four major Swedish banks’ by estimating the sensitivity in stock return to exchange rate changes. By using weekly data, estimated exposures are constructed by regressing stock returns on exchange rates. Further the thesis compares the exposure among the banks and applies exchange rate determinants in an attempt to seek explanations for the different degrees of exposure. Findings suggest that Swedbank has the pre-eminently highest exposure to the included exchange rates followed by SEB, Nordea and where Handelsbanken has no exposure to any of the individual exchange rates. All banks but Nordea is significantly exposed to the TCW index, which is a weighted exchange rate index. The exchange rate exposure determinants, firm size and foreign assets over total assets, does not seem to explain the variation in the degree of exposure among the banks, implying that the exposure originates from other firm specific characteristics.
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1 Introduction

The exchange rate risk relates to the risk that the value of a firm is negatively affected by changes in exchange rates (Madura, 1989). Exchange rate fluctuations impact on a firm’s expected cash flows from foreign countries, unless perfectly hedged, hence the value of the firm is also affected by the fluctuations. The adoption of the floating exchange rate regime in Sweden in 1992 and the continuous globalization of the financial systems have created new business opportunities but have also led to a riskier business environment. The new environment can be seen as riskier since there is a new market where the firm has no previous experience and there is an increase in competition. The sensitivity in firm value to exchange rate fluctuations will differ widely among firms since the degree of exposure to a large extent depends on the structure of the firm. An important note is that a riskier environment does not necessarily mean higher firm specific risk since firms will engage in hedging strategies to lower and mitigate those risks. Detection and measurement of foreign exchange exposure has been given increasing attention lately as most firms today are linked to the international markets. Understandings of the exchange rate exposure, its determinants and the impact on the firm value are critical for financial decision making, diversification and investing purposes. Firm managers are interested in satisfying the shareholders and thus apply strategies to uphold a stable stock price, without too much fluctuation. The choice of appropriate strategies is a problematic task due to the complexity in measuring the exchange rate exposure. The four major Swedish banks are daily interacting on the international markets and the exchange rate exposure is inevitable. According to the portfolio theory, banks engage in cross-border activities due to diversification and profit purposes. The gains from running cross-border activities are substantial but where the exchange rate risk is an important consideration (Buch, Driscoll & Ostergaard, 2009). Additional international activities banks engage in are e.g. holdings of foreign assets, sell financial solutions to firms with imports and exports, support in mergers and acquisitions, foreign exchange loans to clients and provisions of a variety of other international banking services to clients (Eun & Resnick, 2009). This thesis was motivated by the theoretical point of view that exchange rate movements are a source of macroeconomic uncertainty and have consequently impact on the value of the firm. The degree of excess exchange rate exposure is therefore closely related to the firm’s risk levels (the higher exposure, the higher risk taken by the firm) and accordingly interesting for investors. The particular focus in this thesis is to investigate in the excess exchange rate exposure of the Swedish banking sector, focusing on the four major Swedish banks listed on Nasdaq OMX Stockholm. The focus on the banks stems from their important function in the society and due to the size of the banks, where the banks total assets are four times greater than the Swedish GDP, the banking sector plays a crucial role to the health of Swedish economy (The Swedish Central Bank, 2011). Examining the excess exchange rate exposure on the Swedish banks is the core interest of this study since maintaining a stable banking sector is central to the Swedish economy.

The rest of the thesis is structured as follow: Section 1 provides background on the exchange rate exposure and the major Swedish banks. Section 2 presents the theoretical framework and Section 3 describes the method and data used. Results and analysis is carried out in section 4 and Section 5 concludes the thesis.
1.1 Background

Why should banks be concerned with the exchange rate exposure? The foreign exchange rate market is considered to be one of the most volatile markets and a financial crisis can occur suddenly without any warning. The four major Swedish banks’ assets and liabilities are in one way or another exposed to the price fluctuations hence the banks may experience large losses in short time. To lower or mitigate the exchange rate risk it is essential for banks to have adequate risk strategies. A combination of neglecting the exchange rate risk and the occurrence of unfavourable market events may lead to large foreign exchange losses and/or even bank failures (Wong, Wong, & Leung, 2009). A failure of any of the major Swedish banks would directly lead to complex complications for the whole banking sector due to their interdependence of each other, and further a collapse of the Swedish financial sector would not be far off. The four major Swedish banks Nordea, SEB, Handelsbanken and Swedbank control about 75% of the banking market in Sweden and are thus an important group for the Swedish banking sector (Swedish Bankers’ Association, 2011). It is vital for the health of an economy to maintain a stable and sound financial sector since they perform as an engine for the economy.

The four major Swedish banks have separate risk divisions that actively design and implement hedging strategies to cover for possible exchange rate risks (The Swedish Central Bank, 2011b). In order to be able to hedge these risks, a comprehensive understanding of the exposure and the firm’s vulnerability to exchange rate changes are necessary. A study on the excess exchange rate exposure of the Swedish banking sector provides important insight for risk managers and may help to facilitate in outlining future exchange rate policies. For diversification purposes other parties interested in the excess exchange rate risk are investors and portfolio managers. Hereafter in this thesis Nordea, SEB, Handelsbanken and Swedbank will be referred to as the four major Swedish banks.

1.2 Problem Statement

Due to the theoretical point of view that the exchange rate risk affect the firm value, firm managers and investors will always be interested in the firm’s degree of exposure and its sensitivity to changes in exchange rates. With increasing globalization of markets and foreign operations, detection and measurement of the exchange rate exposure of firms is a widely investigate topic by researchers, risk management, and Central Banks. However, up to now no studies have investigated specifically on the Swedish banking sector and that is a gap this thesis aims to fill. Movements in exchange rates are a source of macroeconomic uncertainty and are unpredictable in the long run. Firms’ with high exposure to exchange rates may experience substantial losses due to unfavourable changes in currencies and it is therefore important to not only measure the exposure but also to identify the sources of the exposure. The four major Swedish banks have an extensive amount of foreign denominated holdings, frequent involvement in international transactions and are therefore daily exposed to movements of the foreign exchange market. When the domestic market is small, expanding the business cross-borders becomes more important. Two, among many,
reasons for this cross-border expansion are to be attractive to clients with global businesses and to maintain diversified funding portfolio. The results from this investigation will bring knowledge about the foreign exchange risk of the four major Swedish banks.

1.3 Purpose

The purpose of this thesis is to investigate in the size and the significance of the excess exchange rate exposure of the four major Swedish Banks, Nordea, SEB, Handelsbanken and Swedbank. Further, a comparison between the exposure among the banks and a benchmark is carried out to check if the banks experience a higher exposure than non-financial firms. By using identified determinants of exchange rate exposure, the thesis seeks an explanation to the variations in exchange rate exposure among the banks.

1.4 Review of literature

There are a great number of studies on the relationship between firm value and exchange rate changes. The first study on the relationship was by Frank and Young (1972), which investigate the effect of exchange rate movements on stock prices of a sample of multinational firms. Their result shows that exchange rates had no impact on the stock prices. The years following, a great amount of empirical studies have been investigating in the responsiveness of stock returns on exchange rates, but the variations in the results are just as great as the number of studies made. Dominguez and Tesar (2005) investigate in a broad sample of eight non-U.S firms over a relative long time period (1980-1999) where five out of eight countries show significant exposure to changes in exchange rates. Moreover they discover that the number firms affected and the currencies that carry the highest exposure, changes over time indicating that firm adjust the hedging strategies.

Chi, Tripe and Young (2007) examines the exchange rate exposure of the four major Australian banks and find no significant relationship between the banks’ stock returns and foreign exchange rates, and similar results are found by Zhao (2009), Bartov and Bodnar (1994) and Jorion (1990). Solakoglu and Demir (2009) investigates in the Turkish financial sector and neither finds a relation between stock returns and exchange rates, however they are overlooking the significance of the exposure coefficient.

There is great variation in the previous research on the significance of the relationship between firm value and exchange rates or not. Further, a number of determinants appear to play a role in the frequency of detecting the exposure. Following is a short review of literature on some determinants of exchange rate exposure.

Hutson and Stevenson (2008) find that, when investigating on the country level, the openness of the economy plays a vital role when trying to detect the exchange rate exposure where the more open an economy is, the higher degree of exposure is expected. Chamberlain, Howe and Popper (1996) investigate in the exchange rate exposure in a sample of U.S and Japanese banks by testing the sensitivity in equity return to exchange rate changes. The authors find that a significant fraction of the U.S banks stock returns correlate to the exchange rate changes, but only a few of the Japanese banks show significant exposure. The
results by Chamberlain et. al. (1996) is contradictive to the findings of Hutson and Stevenson (2008) since the former authors find Japan with lower exposure than the U.S even though the Japanese economy is considered a more open economy. A study of He and Ng (1998) on the other hand finds a significant number of Japanese corporations to be significantly exposed.

He and Ng’s (1998) study of Japanese market with a sample of 171 multinational firms between 1979-1993 additionally find that the size of the firm is a crucial determinant for the degree of exchange rate exposure. The firm size is confirmed as a determinant in a study by Wong, Wong and Leung (2009) when testing for a sample of 14 listed Chinese banks. Dominguez and Tesar (2005) investigate in multinational firms and confirm the size of firms as a determinant of exposure where small firms face higher degree of exposure.

Booth and Rotenberg (1990), Bodnar and Gentry (1993) and He and Ng (1998) find that the ratio of foreign assets over total assets and the degree of exchange rate exposure showed significance as a determinant of exposure.

Above stated findings on determinants of exchange rate exposure are discussed later in this thesis in an attempt to provide an explanation to the exposure of the major Swedish banks.

Another fundamental factor when estimating exchange rate exposure is the choice of model. Martin and Mauer (2004) discuss the benefits of the two most frequent used models when estimating the exchange rate exposure, namely the cash flow model and the capital market model. The authors use a sample of U.S. banks when comparing which of the two models has the highest frequency in sensing the exchange rate exposure. The investigation shows that the capital market approach captures the overall impact of exchange rate risk, as well as if a market variable is included the excess exposure allows to be captured. The cash flow approach on the other hand is better suited for investigations on determinants of exposure where firm specific factors are the main focus in the analyse. Another finding is that the capital market approach succeeds in including future expectations, where cash flow approach looks on realized cash flow and therefore does not include expectations. Griffin and Stultz (2001) argue that the capital market approach is favourable due to the complexity of exchange rate effects on firm value. With regards to the findings of Martin and Mauer (2004) and the statements by Griffin and Stultz (2001) the capital market approach is used in this thesis to estimate the exchange rate exposure of the major Swedish banks.

To summarize, the empirical studies on the relationship between firm value and exchange rate changes are many and the results vary in significance. This paper contributes with an investigation on the exchange rate exposure on a hitherto new sample, namely the four major Swedish banks. As stated above, previous studies shows that the openness of the economy may affect the degree of exposure and Sweden is a small open economy heavily dependent on imports and exports. The banks are of particular interest since part of the bank’s business is, among other things, to assist clients with global operations to hedge against unfavourable movements in exchange rates. Thus the banks themselves should be very well hedged considering the internal expertise found in the company.
2 Theoretical Framework

2.1 The Swedish Banks in the International Arena

Today the world is more globalized than ever and the four major Swedish banks are daily acting on the international markets. The banks provide assistance to clients in activities such as import and export, arrangements for foreign exchange, foreign investments, hedging strategies to reduce market rate risks etc. Since the banks have the capabilities to engage in foreign exchange they also trade products for their own account such as raising funds and instantaneously they are exposed to exchange rate risk (Eun & Resnick, 2009). Two reasons to the foreign funding are that the international markets tend to be more liquid (hence the banks can access cheaper funding) and it allows the banks to have a diversified debt portfolio. The dependency of the foreign funding poses an increase in risk in the sense that uncertainty in foreign markets rapidly spread to the Swedish financial system and the risk that exchange rate movements may cause losses.

It was during the second half of the 1990’s that the Swedish banks started their international expansion by seeking funding alternatives on the international money market. Today the four major Swedish banks have about 60 per cent of their financing through the international money market (see Graph 1 for details). Primary currencies in which the banks raise funds other than the Swedish krona (SEK) are the Euro (EUR), US dollar (USD) and Danish krone (DKK). The USD financing is mainly short-term borrowing, while the EUR financing is more balanced between the short-term and long-term borrowing. Although there has been a decrease in the foreign funding in the recent years, in their semi-annual report the Swedish Central Bank urges the banks to lower the dependence of the foreign funding further, mainly the short-term USD financing since this type of funding is highly inaccessible in times of financial distress. (The Swedish Central Bank, 2011a)

Graph 1 Banks Total Funding in Foreign Currency

<table>
<thead>
<tr>
<th></th>
<th>SEK</th>
<th>EUR</th>
<th>USD</th>
<th>DKK</th>
<th>NOK</th>
<th>Övriga valutor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding</td>
<td>37%</td>
<td>24%</td>
<td>22%</td>
<td>10%</td>
<td>2%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Note: Chart 2.1 presents the banks’ total funding in foreign currency as for Dec 2011 (The Swedish Central Bank, 2011)

As stated previous, foreign denominated assets and liabilities are affected by changes in the exchange rates and consequently the value of the firm is affected. In addition to the fact that the banks foreign cash flows are affected, foreign denominated assets will change in value from fluctuations in the exchange rates. Assets increase in value from a strengthening of the foreign currency relative to domestic currency and decrease in value as a result from a strengthening of the domestic currency relative to foreign currency.
The four major Swedish banks have an extensive amount of holdings in foreign assets. The sum of the banks’ total assets held in foreign currency in December 2007 accounted for 32 297 029 MSEK and by the end of 2010 total assets in foreign currency showed a decreased to an amount of 5 006 225 MSEK. Details on total holdings in foreign assets among the banks in the most relevant currencies are shown below in Table 1 (2007) and Table 2 (2010).

Table 1 Banks Total Holdings in Foreign Currency 2007

<table>
<thead>
<tr>
<th>Dec, 31, 2007 (MSEK)</th>
<th>EUR</th>
<th>DKK</th>
<th>NOK</th>
<th>USD</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordea</td>
<td>11 326 931</td>
<td>8 605 831</td>
<td>5 093 823</td>
<td>2 212 659</td>
<td>1 299 349</td>
<td>28 538 593</td>
</tr>
<tr>
<td>SEB</td>
<td>950 800</td>
<td>240 000</td>
<td>419 500</td>
<td>15 300</td>
<td>109 800</td>
<td>1 735 400</td>
</tr>
<tr>
<td>Handelsbanken</td>
<td>839 237</td>
<td>245 009</td>
<td>95 015</td>
<td>177 259</td>
<td>138 229</td>
<td>1 494 749</td>
</tr>
<tr>
<td>Swedbank</td>
<td>205 490</td>
<td>-</td>
<td>-</td>
<td>213 178</td>
<td>109 619</td>
<td>528 287</td>
</tr>
<tr>
<td>Total</td>
<td>13 322 458</td>
<td>9 090 840</td>
<td>5 608 338</td>
<td>2 618 396</td>
<td>1 656 997</td>
<td>32 297 029</td>
</tr>
</tbody>
</table>

Note: Table 1 presents each bank’s total holdings in foreign currency in December 2007. Data obtained from each banks’ annual report.

Table 2 Banks Total Holdings in Foreign Currency 2010

<table>
<thead>
<tr>
<th>31, Dec, 2010 (MSEK)</th>
<th>EUR</th>
<th>DKK</th>
<th>NOK</th>
<th>USD</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordea</td>
<td>1 847 135</td>
<td>1 156</td>
<td>575 544</td>
<td>390 291</td>
<td>183 455</td>
<td>2 997 581</td>
</tr>
<tr>
<td>SEB</td>
<td>214 178</td>
<td>43 319</td>
<td>181 035</td>
<td>126 781</td>
<td>82 895</td>
<td>648 208</td>
</tr>
<tr>
<td>Handelsbanken</td>
<td>256 446</td>
<td>69 836</td>
<td>200 628</td>
<td>348 702</td>
<td>111 187</td>
<td>986 799</td>
</tr>
<tr>
<td>Swedbank</td>
<td>96 877</td>
<td>20 612</td>
<td>51 449</td>
<td>28 983</td>
<td>175 716</td>
<td>373 637</td>
</tr>
<tr>
<td>Total</td>
<td>2 414 636</td>
<td>134 923</td>
<td>1 008 656</td>
<td>894 757</td>
<td>553 253</td>
<td>5 006 225</td>
</tr>
</tbody>
</table>

Note: Table 2 presents each bank’s total holdings in foreign currency in December 2011. Data obtained from each banks’ annual report.

The four major Swedish banks have strict and similar interventions to control and limit for exchange rate risks. Within the banks it is the board of directors’ duty to establish the accumulated limit of risk that should not be exceeded in the banks business. The limit is then divided and allocated by a specific group among the risk-prone divisions within the bank. To quantify the market risk, the banks use different methods, mainly value-at-risk measures, sensitivity tests and stress tests. (The Swedish Central Bank, 2002)

Following subsections provides a description of the common risk measures used by the banks. Further a detailed description of the specific banks and their risk strategies are provided.

2.1.1 Risk measures

VaR measures has three components: a time period, a confidence level and a loss amount and estimates the losses that can be experienced in a worst case scenario by answering the question: What is the most I can – with a 95 per cent or 99 per cent level of confidence – expect to lose over the next chosen period? The sensitivity test measures how much the value of assets and liabilities are affected by a changed in the underlying market variable e.g. +/- 0.05 per cent change in interest rates, exchange rate or share price index.

In addition to the banks individual hedging strategies, Basel III (introduced in 2010-2011) is a regulatory standard on banks and with requirements on the bank’s liquidity and lever-
age. According to an investigation by (Swedish Central Bank, 2011) the four major Swedish banks are considerable safe and are able to reach the new requirements of Basel III without major difficulties.

2.1.2 Nordea
To identify the market risk Nordea most frequently uses Value-at-risk (VaR). Nordea has a risk committee that establishes the allocation of the risk limits between the two divisions Group Treasury and Nordea Markets. These are the two divisions that carry the market risks the bank faces. The limits are established in line with the business strategies and are reviewed at least once a year. Nordea Markets is responsible for the customer-driven trading while Group Treasury has the overall responsibility for managing the bank’s assets, equities and liabilities. To limit currency risks Nordea is matching cash inflows and outflows as much as possible. VaR measures Nordea’s aggregated market risk and in the end of 2011 was a total amount of 415 MSEK. Nordea has 9 home markets where the total lending and total customers are largest in Denmark closely followed by Sweden (the remaining home markets are in Norway, Finland, Russia, Poland, Estonia, Latvia, Lithuania). (Nordea, 2011)

2.1.3 SEB
SEB uses a mix of the two instruments and uses a sensitivity test for detecting risks in different divisions and VaR to identify the aggregate market risk. After the board of directors has established the aggregated risk limits the Asset and Liability Committee allocates the limits to the risk taking businesses, which are the customer-driven trade, the bank’s liquidity portfolio and the life insurance business. SEB has its home markets in Denmark, Estonia, Finland, Latvia, Lithuania, Finland, Norway, Germany and Sweden, which is their largest market, further SEB has smaller branches spread all over the world. (SEB, 2011)

2.1.4 Handelsbanken
Handelsbanken is primarily using a sensitivity test to identify the market risk and stress test to measure the risks. Further the bank uses currency swaps to hedge the currency risk. Handelsbanken has a separate risk control division that has the responsibility to identify, measure and control the relevant aggregated risk faced by the bank and report to the Board of Directors how the risks should be handled. The risk management is continuously evaluated and inspected. Handelsbanken has a very restrictive market risk policy and only takes risks when absolutely necessary but then very controlled and well hedged. The divisions to which the risk limits are allocated are Handelsbanken Markets who is responsible for customer driven-trading, The central finance department for internal risk control and Handelsbanken Liv which deals with the banks supply of life insurances. A stress test by the end of 2011 reported a loss of 81 MSEK as the worst-case scenario. Handelsbanken has its home markets in Sweden, Denmark, Norway and Great Britain and branches in about 17 other countries. (Handelsbanken, 2011)
2.1.5 Swedbank

Swedbank is a user of the sensitivity test to identify the market risk. The Board of directors are running distinct risk policies where each division and subsidiary is responsible for its own risk taking. Swedbank has their business divided between in Sweden, Estonia, Latvia and Lithuania (the Baltic region). Both the largest share of private customers and corporate customers are located in the Baltic region. (Swedbank, 2011)

2.2 Exchange Rate Exposure

This section gives a brief introduction on the term exchange rate exposure and its various types. A standard definition on exchange rate exposure widely used by researchers and originally stated by (Adler & Dumas, 1984) explains the exchange rate exposure as the relationship between the firms’ return on stock and changes in the exchange rate. Exchange rate exposure therefore exists when the value of firms are moved by fluctuation in foreign currencies relative to the domestic currency. On the international market currency fluctuations are a part of the everyday life yet they are unpredictable and the firm’s ability to manage risks determines how severe the firm is affected. Eun and Resnick (2009) states three main types of exchange rate exposure where exchange rate risk may arise and a description of each is provided here:

2.2.1 Transaction Exposure

The transaction exposure is the risk of exchange rate movements after the firm have entered and settled into financial obligations and until the actual transaction date. Firms with payables or receivables denominated in foreign currency may experience large losses if the transaction exposure is not taken carefully (Eun & Resnick, 2009). The transaction exposure usually measures as the net value of payments in each currency, where a higher net value results in higher degree of exposure to exchange rate fluctuations. This is a well-defined problem and firms can easily take actions to hedge this sort of exposure by the use of derivatives.

2.2.2 Translation Exposure

The translation exposure occurs when a firm converts its foreign denominated assets and liabilities into domestic currency at the current exchange rate. This is done when the annual or quarterly reports are written. If the currency has changed since the last report it may result in currency gains or losses and should be stated in the consolidated statement of income (Bennet, 1996). This exposure is only an accounting measure and cash flows are realize by the time of disposal (Grinblatt & Titman, 2002).

2.2.3 Economic Exposure

Economic exposure connotes the effect a change in the exchange rate has on the economic value of the firm. The economic value is the sum of all future cash flows discounted to the present value. The economic exposure is has a long time perspective and is thus difficult to estimate. (Oxelheim & Wihlborg, 2005)
2.2.4 Direct and Indirect Exposure

There are two classifications of the exposure, direct exposure and indirect exposure. Direct exposure occurs when transactions needs to be converted into one currency or another by the firms itself. These are often easy to detect and firms are hedged to prevent major losses. Indirect exposure is difficult to measure and control since the firm itself is not exposed to the risk, instead it may be that clients of the firm that are exposed to exchange rate changes. If a client is negatively affected by a currency change this may lead to difficulties for the client to fulfil its obligations to the bank and thus in turn the bank is also affected. Since the indirect exposure is difficult to detect it is also challenging to hedge this type exposure (Bennet, 1996).

2.3 APT approach to Estimate of Foreign Exchange Exposure

The Capital Market Approach used in this thesis to estimate the sensitivity in market value (measured as stock returns) of the banks to changes in exchange rates. As a market portfolio is included the exposure can be an interpretation of the CAPM. However, as the approach is used not to test the CAPM but instead to isolate the relationship between market value of the firm and exchange rate changes, a better suited approach can be the APT model. The APT model is less restrictive than the CAPM in its assumptions and states only three assumptions: 1) Capital Markets are perfectly competitive 2) Investors always prefer more wealth to less wealth with certainty 3) The stochastic process generating asset returns can be presented as $K$ factor model. The APT model is applied to measure the effects of currency changes on the market value of firms with respect to a market factor. The APT model is a theory of asset pricing, where stock returns can be shown as a linear function of different macroeconomic factors. The sensitivity in the stock returns to each of the factors is represented by factor-specific betas. The resulting expected return is used to price the stock correctly, however if the price deviates, arbitrage will bring it back into the security market line (SML).
3 Method

3.1 Description of Model

To satisfy the purpose of this thesis a quantitative analysis is carried out and is a deductive operation due to the amount of existing literature on the subject. The exposure coefficient is estimated by using a capital market approach as a framework (Dominguez & Tesar, 2005; Wong, Wong & Leung, 2008 and Chi, Tripe & Young, 2010) to isolate the relationship between firm value (defined as stock returns) and exchange rate changes. The capital market approach not only allows for detection of the relationship between excess returns and the exchange rates but also shows the degree of the estimated exposure. The estimated exposure is represented by $\beta_2$, and its value indicates the degree of exposure. The exposure estimate is obtained by running regressions based on Equation (1) with stock returns as the dependent variable and return on market index and the individual exchange rates as independent variables:

$$R_{i,t} = \alpha_i + \beta_{1,i}R_{m,t} + \beta_{2,i}XR_t + \epsilon_{i,t}. \quad (1)$$

Where $R_{i,t}$ is the return on bank $i$ at time $t$, $\beta_1$ represents the market beta, $R_{m,t}$ is the return on the market portfolio at time $t$, $XR_t$ is the return on exchange rate and $\beta_2$ describes the change in stock returns that can be explained by the exchange rate return.

As argued by Choi and Prasad on the use of a two-factor model "...[Equation 1] is not a model of asset pricing but a factor model that allows measurement of factor sensitivities" (Choi & Prasad, 1995, pp. 78).

With the inclusion of a market variable the estimated betas will show the excess exposure faced by the banks. Thus a $\beta_2$ equal to zero does not mean the firm faces no exposure, but that the firm faces the same exposure as the market portfolio. The returns on the bank stock, the market and the exchange rates will be calculated as compounded by using the formula:

$$\text{Return} = \ln \left( \frac{P_t}{P_{t-1}} \right) \quad (2)$$

Seven regressions were performed on each bank, based on equation 1, and every regression using the individual currency pair in the form of domestic currency in terms of foreign currency. Previous studies have been using a trade weighted currency index instead of using the individual exchange rates (e.g. see Doidge, Griffin and Williamson, 2002). To measure if the banks show different results in estimated exposure when using a trade weighted currency index, I include a regression on Equation (1) with the TCW index return as the independent variable instead of the individual exchange rate return. TCW (Total Competitiveness Weights) is a trade-weighted index measuring the value of the Swedish krona (SEK) to a basket of other currencies, where the IMF calculates the weights. TCW is an index where the SEK is compared to other currencies as a bilateral exchange rate, and the weight of each bilateral exchange rate is based on the amount of trade between Sweden and 21 other countries (a list of all currencies and respective weight is provided in Appendix 1). Include-
ing the TCW-index contributes with one essential function, namely it checks the robustness of the estimated exposure. If the bank fails to show any significant exposure to any of the individual exchange rate, it does not imply that the bank has no exposure but that the chosen exchange rates are not significant to the bank, thus including the index checks if the bank shows exposure to a basket of other currencies and hence checks the robustness of the exposure.

The thesis further includes an exchange rate exposure estimation of a benchmark, which allows for a comparison on the exposure of banks’ and the benchmark. The benchmark consists of the four largest (based on market capitalization) non-financial corporations in Sweden and is Atlas Copco, Ericsson, H&M and TeliaSonera. The benchmark corporations are also traded on the Nasdaq OMX Stockholm. This comparison is of interest since it provides a clearer picture on the amount of excess exchange rate exposure of the banks. The benchmark does not possess the same internal expertise on foreign exchange and the banks can be expected to have less exposure.

After estimations on the exposure of the major banks and the benchmark, the thesis continues by applying determinants of exchange rate exposure to see if it can shed light on why the exposure diversify among the four major Swedish banks. The investigated determinants are proven to show a significant relation to the exposure coefficient in previous studies (determinants are identified in the Review of literature section).

### 3.2 Hypotheses

The thesis hypothesizes that there is a correlation between the banks’ firm values and fluctuations in the investigated exchange rates. This is assumed since the banks are highly interacting on the foreign exchange market both for their own account and for client purposes. Because movements in exchange rates are unpredictable in the long run it can be hard to maintain a perfect hedge throughout. In addition, it has been proven that the size and the openness of the economy plays a role in the detection of exposure, and since these factors can both be applied to Sweden, banks with Sweden as their home market are expected to show some degree of exposure. Moreover, the banks are frequently indirect exposed to exchange rate changes, with the exposure arising from providing services to global clients. The indirect exposure is problematic to control and hedge against, therefore it can also be expected that the four banks are more sensitive to exchange rate changes than the benchmark.

The alternative to the statement above, is that the banks are unaffected by the fluctuations in the exchange rates or that the investors do not care about the exposure, in other words no significant relationship between the banks’ firm value and exchange rate changes is detected. An explanation to this could be that the banks are efficient in hedging hence no significant exchange rate exposure is to be detected among the banks. Furthermore, because of the banks’ internal expertise on the foreign exchange market, the banks can be expected to have properly hedged to those currencies in which the bank may experience losses when unfavourable market events arise. In theory it is possible to entirely hedge its foreign ex-
change exposure, which would show an insignificant correlation between firm value and exchange rates (Nydahl, 1998).

The stated null hypothesis follows:

- $H_0$: There is no relationship between firm value and exchange rate changes
- $H_1$: There is a relationship between firm value and exchange rate changes.

If we reject the null hypothesis above and conclude there is a significant relationship between firm value and exchange rate movements, the thesis expects that the estimated exposure coefficient have a non-zero value. A correlation equal to zero would imply that the bank have no excess exposure than the overall exchange rate exposure faced by the market, but due to the nature of the financial markets the banks are expected to show higher exposure than the overall market.

### 3.3 Data Description

The sample consists of the four major Swedish banks Nordea, SEB, Handelsbanken and Swedbank. Weekly data from 20th July 2004 to 13th March 2012 is used, where stock prices are collected on Tuesdays to avoid any occurrence of Monday-effects\(^1\). Weekly data is used because the issue of “the correct” time horizon has not yet been solved, thus weekly data is used over of daily data to have as many observations as possible to give power to the test (Rees & Unni, 1999). The estimated exposure is represented by the beta coefficient and explains the change in firm value caused by changes in the exchange rate. The value of the beta coefficient represents the degree of exposure e.g. a positive coefficient indicates that a one per cent increase (decrease) in exchange rate is expected to cause a percentage increase (decrease) in stock return equal to the value of the beta coefficient.

The banks’ weekly stock prices and the market index prices are collected and compiled from Yahoo Finance and are adjusted for splits and dividends. The market index is represented by the OMXS30 index, which is a market value-weighted index that represents the 30 most traded stocks on the Stockholm Stock Exchange. Returns are calculated as compounded returns and are used in the regression since this result in lower value (except for zero returns) thus implying that the effect of any outliers or data errors is reduced (Ryan & Worthington, 2004). The weekly cross exchange rates are collected from The Swedish Central Bank and are also converted into compounded returns. The TCW index (Total Competitiveness Weights) is weekly and derived from the Swedish Central Banks database where the same time horizon is used, 20th July 2004 to 13th March 2012 and is weekly average data.

\(^1\) The phenomenon of the Monday effect states that stock returns on Mondays are often less than other days
The weekly exchange rates are collected from The Swedish Central Bank and are also translated into compounded returns for consistency. The included exchange rates are SEK/USD, SEK/EUR, SEK/GBP, SEK/DKK, SEK/NOK, SEK/JPY and SEK/CNY.

3.3.1 Choice of Market Portfolio

This thesis analyse the effect of the exchange rate exposure on stock returns separately from the market exposure. This because the purpose of the thesis is to investigate in the individual banks excess exposure and further try to explain the reason to the excess exposure. The particular interest of the thesis is to investigate in the firm specific exposure rather than the overall exposure since it is the firm specific exposure that is of interest for investors and firm owners. The choice of using an equally weighted index or a value-weighted index shows no difference in a test by Dominguez & Tesar (2005). In this study the value-weighted index OMXS30 (representing the 30 most traded stocks on the Stockholm Stock Exchange) is used to represent the market.

3.3.2 Exchange Rates

What defines the relevant exchange rates that should be included in the analysis? No empirical studies have yet provided a strategy on how to select the most relevant exchange rates. Widely used is a trade-weighted portfolio of currencies, however very poor results are found when using this method (Doidge, Griffin & Williamson, 2002). The results may be smoothed out and high exposure in one currency may be off set with no exposure in another currency. Further, using an exchange rate index will not provide an overlook on the firm’s responses to different exchange rates, meaning that the firm can be positively related to one currency and negatively related to another that is an effect that will be smoothed out by using an index. Another issue when choosing relevant currencies is that the firms are expected to be properly hedged and the risks limited to the currencies where the firm has much of its activities, while the currencies with no obvious linkage and more indirect effects may be overlooked. With respect to these issues and to the aim of this thesis, which is to find the key currencies the Swedish banks are exposed to, currency pairs will be used individually in the equation to avoid the currencies to offset each other. The chosen exchange rates for this investigation are those in which the Swedish banks have most of their foreign operations namely the US dollar (USD), the euro (EUR), the British pound (GBP), the Danish krone (DKK), the Norwegian krona (NOK). In addition the Chinese yuan (CNY) and Japanese yen (JPY) are included since these currencies are the two countries on the top 15 trading partners with the Swedish economy (Statistics Sweden, 2012). The Danish krone has been pegged to the EUR since the introduction of the latter. This will result in very high correlation between the two currencies but since the regressions will be run on the exchange rate individually this will not be a problem. Both currencies are included in this investigation since they are both two important currencies to the Swedish banks and should therefore not be excluded. Though, the banks are expected to show similar exposure to the SEK/EUR and SEK/DKK exchange rates. Further the CNY is pegged to the

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2 A statistical summary of the variables included in the study is presented in Appendix 2.
USD but the same argument applies here as for including both the DKK and the EUR, thus banks expect to show close to similar exposures to the SEK/CNY and SEK/USD.

The exchange rate is the market price for which one currency can be traded for another. In this study the exchange rate are stated as indirect quotes (domestic currency being fixed at one unit and where the foreign currency is a variable amount). Therefore, an increase in the exchange rate indicates a strengthening of the domestic currency, alternatively a weakening of the foreign currency relative to the other currency.

As for testing the robustness of the estimated exposures, a currency index is included in the investigating, however it should be noted that the main focus lies on the individual exchange rates.

3.3.3 Description of Benchmark

In this thesis a benchmark is included to allow for a comparison on the degree of exposure of the banks and other firms. The benchmark is represented by the four largest corporations in Sweden (defined by market capitalization); Atlas Copco, Ericsson, H&M and Telia Sonera, which are all listed on the Nasdaq OMX Stockholm. The benchmark represents non-financial firms with both assets and liabilities denominated in foreign currencies and thus faces the market risk similar to the banks. The market divisions within the banks provide financial solutions and expertise on hedging to global customers and are a part of the banks business, thus the banks have economies of scale in hedging. Due to the banks expertise in hedging along with their economies of scale it is interesting to make a comparison on the sensitivity in banks’ stock returns and the sensitivity of the benchmark stock returns. The benchmark exposures are measured in the same way as for the banks, using the same equation involving exchange rates and market portfolio³.

3.4 Delimitations

3.4.1 Exposure on Firm level

This model will not provide a measure of total exposure of the banks in the banking sector but instead measure the exposure on firm level. The advantage of a total approach would allow for comparison between different industries and reasons to the variations of exposure among sectors. However, looking at the exposure on industry level instead of firm level may leave us with biased results due to the effect that the aggregation may even out the firm specific exposures (Dominguez & Tesar, 2001). Since the aim here is to investigate in the individual exchange rate exposure of the banks, the total approach is ignored.

3.4.2 Weak statistical significance

Previous studies have met some limitations in determining the statistically significance of the test on the relation between firm value and exchange rate movements. As discussed by Bartov and Bodnar (1994) there are some possible reasons to why some studies fail to de-

³ Descriptive statistics of the benchmark is provided in Appendix 2
tect the exchange rate exposure. The main reason tends to be poor research design e.g. weaknesses in sample selection such as inclusion of banks with no linkages to international markets and chosen time horizons. Longer time horizons seem to capture the exposure better than short horizons. Dominguez and Tesar (2005) find significant exposure for a fraction of firms, however, the firms affected and the currencies that carry the exposure changes over time. This indicates that firms adjust their hedging strategies over time, which should be a natural action for all firms.
4 Estimated Exposure of the Swedish major Banks: Result and Analysis.

This section is divided into three subsections where the results from running the regressions on the banks and the benchmark are presented and analysed. Subsection one concerns the banks’ estimated exposures to the individual exchange rates and the TCW-index. Subsection two provides an analysis on the determinants of the exposure and subsection three presents a comparison on the degree of exposure between the banks and the benchmark.

4.1 The banks’ estimated exposure

Table 3 provides a summary of the results from running regressions on Equation (1) with the banks stock returns as the dependent variable and the individual exchange rates and the TCW-index as the dependent variable. The investigation results in eight estimated exchange rate exposure coefficients on each bank and is represented by $\beta_2$. The Sig. represents the p-value and tests the significance of the exposure. A p-value smaller than the significance level (0.01, 0.05 or 0.10) indicates that the firm is significantly exposed to the exchange rate.

<table>
<thead>
<tr>
<th></th>
<th>Nordea</th>
<th>SEB</th>
<th>Handelsbanken</th>
<th>Swedbank</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_2$</td>
<td>0.300</td>
<td>0.201</td>
<td>0.198</td>
<td>0.230</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.044**</td>
<td>0.488</td>
<td>0.289</td>
<td>0.428</td>
</tr>
<tr>
<td>$\beta_2$</td>
<td>0.469</td>
<td>-0.206</td>
<td>0.693</td>
<td>0.693</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.005*</td>
<td>0.033**</td>
<td>0.332</td>
<td>0.034**</td>
</tr>
<tr>
<td>$\beta_2$</td>
<td>0.049</td>
<td>-0.082</td>
<td>-0.339</td>
<td>-0.339</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.722</td>
<td>0.637</td>
<td>0.208</td>
<td>0.208</td>
</tr>
<tr>
<td>$\beta_2$</td>
<td>0.659</td>
<td>0.735</td>
<td>1.866</td>
<td>0.797</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000*</td>
<td>0.000*</td>
<td>0.000*</td>
<td>0.000*</td>
</tr>
<tr>
<td>SEK/USD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK/EUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK/GBP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK/DKK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK/NOK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK/JPY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK/CNY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCW-index</td>
<td>-0.242</td>
<td>0.382</td>
<td>-1.424</td>
<td>0.000*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.456</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.076***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.749</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.007*</td>
</tr>
</tbody>
</table>

Notes:
(1) Table 3 shows the estimated exposure coefficient ($\beta_2$) for each bank and individual exchange rate obtained from running regressions on each bank with each individual exchange rate on the following equation: $R_{it} = \alpha_i + \beta_1 R_{mt} + \beta_2 XR_t + \epsilon_{it}$, where $R_{it}$ is the return on bank stock, $\beta_1$ market beta, $R_{mt}$ return on market portfolio, $XR_t$ return on exchange rate, $\beta_2$ exchange rate exposure and $\epsilon_{it}$ is the error term.

(2) *, **, *** Denote statistical significance at the 1%, 5% and 10% levels, respectively.

(3) Average exposures: Nordea (0.109), SEB (0.581), Handelsbanken (0.057), Swedbank (1.001)

A positive (negative) exposure coefficient indicates that a 1% increase in the exchange rate will result in an increase (decrease) in the stock return corresponding to the value of the beta coefficient, simultaneously from a 1% decrease in the exchange rate, stock returns can be expected to decrease (increase) by the corresponding value of the beta coefficient. The
foreign exchange rates are quoted as indirect, meaning the domestic currency (SEK) is fixed at one unit and the foreign currency is the variable amount. Thus an increase in the exchange rate can either be a result from an appreciation of the Swedish krona relative to the foreign currency, or depreciation in foreign currency relative to the Swedish krona. Those banks with significant exposure also have a positive exposure coefficient, which implies that the banks’ stock return is expected to increase from an increase in exchange rate. This in turn implies that the banks gain in firm value from a strong Swedish krona relative to foreign currency and are harmed by a weaker SEK, which can be compared to the behaviour of an importing firm.

A higher value of the TCW-index indicates a weaker SEK, since this indicates that the basket of currencies has been more expensive to buy with SEK. The estimated exposure coefficients of the TCW-index show a negative sign, meaning that the two variables move in opposite direction, thus an increase in TCW-index indicates a reduction in stock return. A significant relationship hence indicates that from a weakening of the SEK, the banks stock return decreases by the corresponding beta value. Although the TCW-index shows a negative exposure coefficient it follows the same relation as the individual exchange rates, namely that the banks’ stock return is expected to increase from an appreciation of SEK.

Nordea has the highest significant exposure, on the 5% level, to the SEK/CNY exchange rate followed by the SEK/USD exchange rate. A 1% increase (decrease) in the exchange rate SEK/CNY corresponds to an increase (decrease) in stock return by 0.336%. Further from a 1% increase (decrease) in the SEK/USD exchange rate we can expect a 0.300% increase (decrease) in Nordea stock return. Significant exposure is also detected to the SEK/JPY (0.235%) on the 10% level. Nordea shows no significant estimated exposure to the TCW-index and overall the bank shows low exposure with the highest exposure to the SEK/CNY (0.336) and lowest to the SEK/JPY (0.235).

SEB is statistically significant, on the 1% level, to the exchange rates SEK/USD and the SEK/JPY. On the 5% level, SEB is significantly exposed to SEK/EUR, SEK/DKK and SEK/CNY and on the 10% level to SEK/NOK exchange rate. Highest increase in stock return derives from an increase in the SEK/EUR exchange rates, where an increase by 1% in the exchange rate increases stock return by 0.697%. Lowest increase corresponds to the SEK/JPY and implies a 0.410% increase in stock return. SEB has estimated exposure of -1.424% to the exchange rate index, which is the highest among the banks. This implies that from a 1% increase in TCW-index, the bank stock return will decrease by 1.424%.

Handelsbanken shows no significant exposure to any of the chosen currency pairs in the regressions. Thus we fail to reject the null hypothesis (which states that there is no significant relationship between stock return and exchange rate return) and we conclude there is a zero relationship between the bank’s stock return and changes in the exchange rates. Yet Handelsbanken is significant negatively exposed, on the 10% level, to the TCW-index by -0.456%, indicating that stock return decreases from an increase in value of the exchange
rate index. Handelsbanken, although exposed, has the lowest exposure to the TCW-index among the banks.

Swedbank is on the 1% level statistically significant exposed to all of the included exchange rates. Highest degree of exposure is identified in the SEK/DKK where stock return increases by 1,866% from a 1% increase in the exchange rate. Lowest exposure derives from the SEK/CNY (0,632%) exchange rate. Swedbank faces significant exposure of -0,749% to the TCW index, thus stock returns can be expected to decrease as a result from an increase in the value of TCW-index.

The results suggests that all banks, except from Handelsbanken, are significantly exposed to the currencies SEK/USD, SEK/JPY and SEK/CNY hence we reject the stated null hypothesis and conclude there is a relationship between the firm value of Nordea, SEB and Swedbank and the exchange rates. All banks, except from Swedbank, show no exposure to the SEK/GBP exchange rate thus we fail to reject the null hypothesis for the three other banks, and we cannot establish a relationship between firm value and the SEK/GBP exchange rate. The diversified exposures among the banks may be due to the banks different hedging strategies. As argued by Allayannis and Ofek (1997) if firms use currency derivatives for hedging purposes, the exchange rate exposure is significantly reduced and may not be able to identify. Another possible reason to the variation in exposure may relate to the choice of relevant exchange rates. For example, Handelsbanken may be exposed to exchange rates that are not included in this investigation, thus the results that Handelsbanken shows no significant excess exposure in this investigation should not be interpreted as if the bank has no exposure, it may just be exposed to other currencies. Evidence to this is found by running the regression on the TCW-index, and as expected Handelsbanken is statistically significant to the currency index. Interestingly Nordea shows no significant exposure to the TCW-index, which could be explained by the fact that the Euro currency counts for 51,966% of the weights in the index and Nordea has no significant exposure to the SEK/EUR exchange rate when testing the exchange rate individually.

The insignificance of exposure to an exchange rate may be a result from perfect currency hedging strategies. The problem of the insignificance is one that has been encountered in previous empirical studies and is difficult to solve since investigating in the result from the banks’ hedging strategies is problematic. This is problematic because the banks not clearly state the undertaken hedges (Booth & Rotenberg, 1990).

To proceed with the estimation of the exposure, the banks are in this section considered as a portfolio representing the Swedish banking sector. Since the four major banks together represent 75% of the total banking business in Sweden it is acceptable to let the four banks represent the banking sector (Swedish Bankers’ Association, 2011). To estimate the exposure the same procedure as above is followed, running eight regressions based on Equation (1) but here with the return on portfolio as dependent variable and the different exchange rates and the TCW-index as the independent variable.
Table 4 Estimated Exposure of Portfolio

<table>
<thead>
<tr>
<th>Portfolio (All banks)</th>
<th>Beta</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEK/USD</td>
<td>0.369</td>
<td>0.000*</td>
</tr>
<tr>
<td>SEK/EUR</td>
<td>0.601</td>
<td>0.002*</td>
</tr>
<tr>
<td>SEK/GBP</td>
<td>0.161</td>
<td>0.191</td>
</tr>
<tr>
<td>SEK/DKK</td>
<td>0.612</td>
<td>0.001*</td>
</tr>
<tr>
<td>SEK/NOK</td>
<td>0.252</td>
<td>0.162</td>
</tr>
<tr>
<td>SEK/JPY</td>
<td>0.337</td>
<td>0.000*</td>
</tr>
<tr>
<td>SEK/CNY</td>
<td>0.367</td>
<td>0.000*</td>
</tr>
<tr>
<td>TCW index</td>
<td>-1.446</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Notes:
1. Table 4 provides the results from running a regression based on the following equation: $R_{it} = \alpha_i + \beta_1 R_{m,t} + \beta_2 X_{R,t} + \varepsilon_{it}$, where $R_{it}$ represents a portfolio of the four banks’ stock returns, $\beta_1$ market beta, $R_{m,t}$ return on market portfolio, $X_{R,t}$ return on exchange rate, $\beta_2$ is the estimated exchange rate exposure and $\varepsilon_{it}$ is the error term.
2. *, **, *** Denote statistical significance at the 1%, 5% and 10% levels, respectively.
3. Average exposure = 0.4665

As shown in table 4, the portfolio is exposed on the 1% level to all exchange rates except the SEK/GBP and SEK/NOK. Highest degree of significant exposure is detected to the SEK/DKK (0.612) exchange rate and lowest to the SEK/JPY (0.337). The result shows an aggregated and smoothed version of the individual banks’ exposures. From the individual regression we know that Swedbank shows significant exposure to all the exchange rates, while Handelsbanken shows no exposure. From the individual regression Swedbank is the only bank with estimated exposure to the SEK/GBP therefore, as could be expected, the portfolio show no significant exposure to the SEK/GBP. Only two of the banks show individual significant exposure to the SEK/NOK, namely Swedbank and SEB, and when combined in the portfolio the exposure to the SEK/NOK is insignificant. The portfolio also shows a negative relationship to the TCW-index and hence the portfolio return will decrease when the TCW-index increases. The results from the test in the portfolio are overall consistent with the estimated exposures of the individual banks.

The estimated exchange rate exposures of the banks are in general meeting the expectations. The stock returns were expected to increase as a result from a strengthening of the Swedish krona. Three interesting, and unexpected, findings were detected. First, Handelsbanken’s is not statistically significant exposed to the individual exchange rates but significant exposure to the exchange rate index. Second, Swedbank has significant estimated exposure to all of the individual exchange rates and the TCW-index. The exposure coefficients of Swedbank varies between 0.122-0.221, with highest degree of exposure to the SEK/DKK and lowest to the SEK/NOK.


4.2 Determinants of Exchange Rate Exposure

Henceforth, the thesis proceeds by applying previous findings on the determinants of exchange rate exposure in an attempt to explain the differences in exposure among the banks. The first determinant that is evaluated is the openness of the Swedish economy. Sweden is considered to be an open economy with a great dependence of the development on the international markets (Bäckström, 1996). With the Swedish banks’ being significantly exposed to six out of the eight included exchange rates, the relationship between the openness of the economy and the exposure can be confirmed in this thesis.

Firm size (measured as total assets) has in several studies showed a positive significant relationship to estimated exchange rate exposure. Wong, Wong and Leung (2009) find a positive relationship between firm size and the exposure, this may reflect that the firm’s exposure increases due to the larger amount of foreign operations and trading positions. Further Wong et al. (2009) argue that smaller firms are more frequent in hedging since they may be harmed more and experience larger losses from currency changes than larger firms. Controversy to previous finding, Chow, Lee and Stolt (1997) find that larger firms are less exposed than smaller firms when investigating in a sample of U.S. multinational firms. The authors explain the relationship to reveal that larger firms have economies of scale in hedging and thus experience less exposure. Additional Dominguez and Tesar (2005) also find that small firms tend to have a higher degree of exposure than large- and medium sized firms. Table 5 shows the Swedish banks’ firm size, which is measured as average total assets from Dec 2004 – Dec 2011, and the banks average exposure.

Table 5 Determinants: Firm Size

<table>
<thead>
<tr>
<th></th>
<th>Firm size</th>
<th>Average Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordea</td>
<td>4 315 600</td>
<td>0.109</td>
</tr>
<tr>
<td>SEB</td>
<td>2 142 074</td>
<td>0.581</td>
</tr>
<tr>
<td>Handelsbanken</td>
<td>1 621 640</td>
<td>0.057</td>
</tr>
<tr>
<td>Swedbank</td>
<td>1 544 958</td>
<td>1.001</td>
</tr>
</tbody>
</table>

Notes:
(1) Firm size is measured as average total assets from Dec 2004 - Dec 2011 and are in MSEK
(2) Average exposure is the average of the banks significant exposures (which are presented in Table 3)

Nordea is by far the largest bank, and Swedbank is about one-third the size of Nordea. According to findings by Wong et. al (2009) and Chow et. al (1997) from Nordea should face the highest exposure, followed by SEB, Handelsbanken and where Swedbank should be expected with the lowest exposure. As proven in this thesis, Swedbank faces the highest exposure, followed by Nordea, SEB and Handelsbanken respectively. From these results, the previous finding that the size of the bank should determine the bank’s degree of exposure cannot be confirmed in this thesis.
Another investigated determinant that has shown significant relationship to the estimated exposure is the amount of the firm’s foreign assets over total assets. Because the value of the firm’s foreign assets is affected by changes in the exchange rate, the amount of foreign assets may thus determine the firm’s sensitivity to changes in the exchange rate. Table 6 presents the banks ranked by the highest proportion of foreign assets and the average exposure. As can be seen no evident relation can be found. Nordea has the highest proportion of foreign assets to total assets, followed by SEB, Handelsbanken and Swedbank respectively where average exposure ranks Swedbank first, followed by SEB, Nordea and Handelsbanken respectively. Swedbank has the lowest ratio of foreign assets but has the highest estimated exposure, and Nordea has the highest ratio of foreign assets but only the third highest total estimated exposure. Thus the relationship between the ratio of foreign assets over total assets and the exchange rate exposure found by Booth and Rotenberg (1990), Bodnar and Gentry (1993) and He and Ng (1998) cannot be confirmed in this investigation.

Table 6 Determinants: Foreign Assets

<table>
<thead>
<tr>
<th></th>
<th>Foreign assets over total assets</th>
<th>Average Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordea</td>
<td>0.64</td>
<td>0.109</td>
</tr>
<tr>
<td>SEB</td>
<td>0.61</td>
<td>0.581</td>
</tr>
<tr>
<td>Handelsbanken</td>
<td>0.32</td>
<td>0.057</td>
</tr>
<tr>
<td>Swedbank</td>
<td>0.25</td>
<td>1.001</td>
</tr>
</tbody>
</table>

Notes:
(1) Data on foreign and total assets are collected and compiled from each banks annual report, and shows an average over the period from Dec 31 2004 to Dec 31 2011.
(2) Average exposure is the average of the banks significant exposures (which are presented in Table 3)

4.3 Bank exposure vs. Non-financial firms exposure

The regressions results from estimating the exchange rate exposure on the benchmark (Table 7) shows that none of the firms are significantly exposed to any of the exchange rates, but where H&M is an exception. H&M shows significant exposure, on the 10% level, to the exchange rate SEK/GBP. Interestingly H&M are negatively exposed, which indicates that from a 1% increase in the SEK/GBP exchange rate, the H&M stock return can be expected to decrease by 0.088%, and vice versa. Thus H&M benefits from a weakening of the Swedish krona (or likewise, an appreciation of the British pound), which is confirming the behaviour of an exporting firm that H&M is considered to be. This result is opposite to the results from the banks stock returns that all shows positive exposure coefficients and benefits from an increase in exchange rate and a strengthening of the Swedish krona. Since the focus in the thesis is to compare the exposure of the banks to the benchmark, a further investigation on the different responses between H&M and the banks will not be carried out.
Table 7 Estimated Exposure of Benchmark

<table>
<thead>
<tr>
<th></th>
<th>Atlas Copco</th>
<th>Ericsson</th>
<th>H&amp;M</th>
<th>Telia Sonera</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>β₂</strong></td>
<td>0.075</td>
<td>0.204</td>
<td>0.085</td>
<td>0.170</td>
</tr>
<tr>
<td><strong>Sig.</strong></td>
<td>0.723</td>
<td>0.621</td>
<td>0.754</td>
<td>0.682</td>
</tr>
<tr>
<td><strong>β₂</strong></td>
<td>-0.013</td>
<td>0.054</td>
<td>0.09</td>
<td>-0.09</td>
</tr>
<tr>
<td><strong>Sig.</strong></td>
<td>0.919</td>
<td>0.827</td>
<td>0.572</td>
<td>0.831</td>
</tr>
<tr>
<td><strong>β₂</strong></td>
<td>-0.113</td>
<td>-0.085</td>
<td>-0.357</td>
<td>-0.052</td>
</tr>
<tr>
<td><strong>Sig.</strong></td>
<td>0.477</td>
<td>0.785</td>
<td>0.078***</td>
<td>0.867</td>
</tr>
<tr>
<td><strong>β₂</strong></td>
<td>-0.078</td>
<td>-0.33</td>
<td>-0.122</td>
<td>-0.33</td>
</tr>
<tr>
<td><strong>Sig.</strong></td>
<td>0.504</td>
<td>0.146</td>
<td>0.411</td>
<td>0.147</td>
</tr>
<tr>
<td><strong>SEK/USD</strong></td>
<td>0.075</td>
<td>0.204</td>
<td>0.085</td>
<td>0.170</td>
</tr>
<tr>
<td><strong>SEK/EUR</strong></td>
<td>0.075</td>
<td>0.754</td>
<td>0.053</td>
<td>0.682</td>
</tr>
<tr>
<td><strong>SEK/GBP</strong></td>
<td>-0.013</td>
<td>0.054</td>
<td>0.09</td>
<td>-0.09</td>
</tr>
<tr>
<td><strong>SEK/DKK</strong></td>
<td>-0.013</td>
<td>0.053</td>
<td>0.09</td>
<td>-0.09</td>
</tr>
<tr>
<td><strong>SEK/NOK</strong></td>
<td>-0.013</td>
<td>0.053</td>
<td>0.09</td>
<td>-0.09</td>
</tr>
<tr>
<td><strong>SEK/JPY</strong></td>
<td>-0.013</td>
<td>0.053</td>
<td>0.09</td>
<td>-0.09</td>
</tr>
<tr>
<td><strong>TCW-index</strong></td>
<td>0.324</td>
<td>0.786</td>
<td>0.036</td>
<td>0.811</td>
</tr>
<tr>
<td><strong>TCW-index</strong></td>
<td>0.324</td>
<td>0.786</td>
<td>0.036</td>
<td>0.811</td>
</tr>
</tbody>
</table>

Notes:
(1) Table 7 shows the estimated exposure coefficient (β₂) for each of the firms used as the benchmark. The estimated exposure coefficient is obtained from running regressions on the following equation: \( R_{i,t} = \alpha_i + \beta_1 R_{m,t} + \beta_2 XR_t + \varepsilon_{i,t} \), where \( R_{i,t} \) is return on firm stock, \( \beta_1 \) market beta, \( R_{m,t} \) return on market portfolio, \( XR_t \) return on exchange rate, \( \beta_2 \) exchange rate exposure and \( \varepsilon_{i,t} \) is the error term.
(2) *, **, *** Denote statistical significance at the 1%, 5% and 10% levels, respectively.
(3) Average exposure for H&M is 0.0446

A comparison between the exposure of the banks and the benchmark shows that the firm values of the banks are more sensitive to exchange rate movements than the non-financial firms. These results are consistent with the findings by Koutmos and Martin (2003) who finds the financial sector to have the highest degree of exposure when investigating in the returns on nine sector indexes across four major countries. Given the nature of the financial sector the results of higher degree of exposure in the banking sector are not surprising, which is a relationship that can be confirmed and also explain the differing results on exposure between the banks and the benchmark.
5 Conclusion

This thesis investigates the foreign exchange rate exposure on the four major Swedish banks Nordea, SEB, Handelsbanken and Swedbank. Using a capital market approach to isolate the relationship between stock returns and exchange rate changes, an exposure coefficient is estimated. The estimated exchange rate exposure is further used to compare the exchange rate sensitivity among the banks and a benchmark of non-financial firms. The exposure is measured as the change in firm value caused by changes in exchange rates.

The estimated exposure varies among the banks and the exchange rates. The first finding is that all banks, except for Handelsbanken, face significant positive exposure to some of the exchange rates and negative exposure to a trade weighted exchange rate index. This implies that the banks’ benefit from an appreciation of the Swedish krona relative to the foreign currency, which is the most likely to be compared to the behaviour of importing firms. Second, the thesis interestingly finds that Swedbank has the pre-eminently highest average estimated exposure and is significantly sensitivity to all of the included exchange rates where the highest exposure derives from the SEK/DKK exchange rate. Handelsbanken on the other hand has no significant exposure to any of the individual exchange rates but to the TCW-index.

The thesis proceeds by applying determinants of exchange rate exposure in an attempt to explain the variation in exposure among the banks. The openness of the economy can in the thesis be confirmed as a determinant as the banks shows significant exposure to the exchange rates. However, no consistent pattern between the investigated determinants and the degree of exposure seem to be found, e.g. when ranking the banks by its sizes, according to previous findings, the largest bank should face either the highest or lowest amount of exposure, which is a pattern that cannot be confirmed in this investigation. Neither can a similar pattern can be detected and the same follows for the ratio of foreign assets. The results show that Nordea, which are by far the largest bank and has the highest ratio of foreign assets, faces only the third highest average exposure. However, Swedbank is the smallest bank with the lowest ratio of foreign assets, and faces the highest average exposure. But since Handelsbanken is about the same size as Swedbank with only a fraction higher ratio of foreign assets but on the other hand faces no significant exposure this investigation has to reject that firm size and ratio of foreign assets as determinants of exchange rate exposure. Hence the thesis fails in confirming the included firm specific factors (firm size and foreign assets over total assets) as determinants to the exposure. Thus the differences in the exposures may be explained by how investor assess other firm specific characteristics such as firm’s ownership structure, risk tolerance, foreign subsidiaries and ownership, and the hedging strategies etc.

At last the thesis proves that the banks have higher significant exposure than a benchmark consisting of four non-financial firms. This may be explained by the nature of the financial markets, in which the banks’ are extensively higher involved. This confirms the findings by Koutmos and Martin (2003) who discover that the financial sector has the highest exposure compared to nine other sectors.
5.1 Suggestions for future studies

As a suggestion for future studies on the topic, a more comprehensive analyse on the determinants of exchange rate exposure of banks could be carried out. Running a cross-sectional regression on the determinants and the exposure would allow checking for significance of the determinant. Also one can investigate in the firms’ different responses to the individual exchange rates and the TCW-index.

Further, it may be simplicity to assume a linear relationship between exchange rate changes and firm value. Future studies could therefore investigate in the non-linear relationship between firm value and exchange rate changes to see if the results differ.
List of references


List of references


List of references


http://www.riksbank.se/upload/Dokument_riksbank/Kat_publicerat/Artiklar_FS/finstab_02_1_artikel2.pdf [Accessed: 2012-03-12]

The Swedish National Institute of Economic Research, NIER. [Pdf] Available at: <http://www.konj.se/download/18.70c52033121865b13988000131172/KIX+%E2%80%93+ett+bredare+v%C3%A4xelkursindex+f%C3%B6r+kronan+med+f%C3%A4rska+vikt+er.pdf> [Accessed: 2012-05-11]


Appendix 1

The weights of the different currencies that are included in the TCW trade weighted currency index.

<table>
<thead>
<tr>
<th>TCW</th>
<th>1991</th>
<th>Europa total</th>
<th>75,755</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro zone</td>
<td>51,966</td>
<td>Norge</td>
<td>5,306</td>
</tr>
<tr>
<td>Tyskland</td>
<td>19,317</td>
<td>Schweiz</td>
<td>2,454</td>
</tr>
<tr>
<td>Frankrike</td>
<td>6,920</td>
<td>Turkiet</td>
<td>0,392</td>
</tr>
<tr>
<td>Nederländerna</td>
<td>4,555</td>
<td>Island</td>
<td>0,098</td>
</tr>
<tr>
<td>Italien</td>
<td>5,700</td>
<td>Nordamerika</td>
<td>14,762</td>
</tr>
<tr>
<td>Finland</td>
<td>5,771</td>
<td>USA</td>
<td>12,031</td>
</tr>
<tr>
<td>Belgien-Luxemburg</td>
<td>3,543</td>
<td>Kanada</td>
<td>1,613</td>
</tr>
<tr>
<td>Spanien</td>
<td>2,265</td>
<td>Mexiko</td>
<td>1,118</td>
</tr>
<tr>
<td>Irland</td>
<td>0,726</td>
<td>Oceanien</td>
<td>1,154</td>
</tr>
<tr>
<td>Österrike</td>
<td>1,511</td>
<td>Australien</td>
<td>0,970</td>
</tr>
<tr>
<td>Portugal</td>
<td>1,220</td>
<td>Nya Zeeland</td>
<td>0,184</td>
</tr>
<tr>
<td>Grekland</td>
<td>0,438</td>
<td>Asien</td>
<td>8,329</td>
</tr>
<tr>
<td>EU-15</td>
<td>66,436</td>
<td>Kina</td>
<td>1,517</td>
</tr>
<tr>
<td>Storbritannien</td>
<td>9,170</td>
<td>Japan</td>
<td>5,396</td>
</tr>
<tr>
<td>Danmark</td>
<td>5,300</td>
<td>Korea</td>
<td>1,416</td>
</tr>
<tr>
<td>EU</td>
<td>67,505</td>
<td>Summa</td>
<td>100</td>
</tr>
<tr>
<td>Polen</td>
<td>0,739</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tjeckien</td>
<td>0,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ungern</td>
<td>0,330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slovakien</td>
<td>0,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
(1) Data derived from the Swedish National Institute of Economic Research, NIER
(2) Numbers are in percentage
## Appendix 2

Below is Descriptive Statistics provided.

### Descriptive Statistics Banks and Exchange Rates

<table>
<thead>
<tr>
<th>Bank or Currency</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordea</td>
<td>399</td>
<td>-2.2979</td>
<td>1.793</td>
<td>-0.006078</td>
<td>0.0450825</td>
<td>0.002</td>
</tr>
<tr>
<td>SEB</td>
<td>399</td>
<td>-4.7122</td>
<td>2.757</td>
<td>-0.013354</td>
<td>0.0700945</td>
<td>0.005</td>
</tr>
<tr>
<td>Handelsbanken</td>
<td>399</td>
<td>-2.2114</td>
<td>1.841</td>
<td>0.001771</td>
<td>0.0415641</td>
<td>0.002</td>
</tr>
<tr>
<td>Swedbank</td>
<td>399</td>
<td>-3.7684</td>
<td>2.617</td>
<td>-0.00186</td>
<td>0.0652387</td>
<td>0.004</td>
</tr>
<tr>
<td>OMXS30</td>
<td>399</td>
<td>-2.2253</td>
<td>1.227</td>
<td>0.001301</td>
<td>0.0323734</td>
<td>0.001</td>
</tr>
<tr>
<td>SEK/USD</td>
<td>399</td>
<td>-0.5823</td>
<td>0.712</td>
<td>-0.00227</td>
<td>0.0152340</td>
<td>0.000</td>
</tr>
<tr>
<td>SEK/EUR</td>
<td>399</td>
<td>-0.3645</td>
<td>0.334</td>
<td>0.000882</td>
<td>0.0077546</td>
<td>0.000</td>
</tr>
<tr>
<td>SEK/GBP</td>
<td>399</td>
<td>-0.0490</td>
<td>0.0493</td>
<td>0.000646</td>
<td>0.0119006</td>
<td>0.000</td>
</tr>
<tr>
<td>SEK/DKK</td>
<td>399</td>
<td>-0.0366</td>
<td>0.0337</td>
<td>-0.00081</td>
<td>0.0077349</td>
<td>0.000</td>
</tr>
<tr>
<td>SEK/NOK</td>
<td>399</td>
<td>-0.0327</td>
<td>0.058</td>
<td>-0.000226</td>
<td>0.0081370</td>
<td>0.000</td>
</tr>
<tr>
<td>SEK/CNY</td>
<td>399</td>
<td>-0.0583</td>
<td>0.0701</td>
<td>-0.000436</td>
<td>0.0149079</td>
<td>0.000</td>
</tr>
<tr>
<td>SEK/JPY</td>
<td>399</td>
<td>-0.0797</td>
<td>0.0636</td>
<td>-0.000465</td>
<td>0.0177925</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Valid N (listwise)**: 399

Table shows the descriptive statistics of the variables included in the regression.

### Descriptive Statistics of Benchmark

<table>
<thead>
<tr>
<th>Company</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telia Sonera</td>
<td>395</td>
<td>-2.215</td>
<td>2.135</td>
<td>-0.001888</td>
<td>0.0352204</td>
<td>0.001</td>
</tr>
<tr>
<td>Atlas Copco</td>
<td>395</td>
<td>-2.675</td>
<td>4.002</td>
<td>-0.002152</td>
<td>0.0638531</td>
<td>0.004</td>
</tr>
<tr>
<td>Ericsson</td>
<td>395</td>
<td>-2.027</td>
<td>3.423</td>
<td>-0.000722</td>
<td>0.049061</td>
<td>0.002</td>
</tr>
<tr>
<td>H&amp;M</td>
<td>395</td>
<td>-1.378</td>
<td>1.659</td>
<td>-0.001082</td>
<td>0.0462105</td>
<td>0.002</td>
</tr>
</tbody>
</table>

**Valid N (listwise)**: 395

Table shows the descriptive statistics of the variables included in the benchmark regression.
Appendix 3

The graphs in this appendix show the movements of exchange rate returns and Nordea (Graph 2) and SEB (Graph 3) stock returns. As seen the exchange rates and the stock returns move overall in the same direction with some more extreme tops and bottoms in the stock return.

Graph 2

Return on Nordea Stock and Exchange rates return

Graph 3

Return on SEB Stock and Exchange rates return
Appendix

Appendix 4

The graphs in this appendix show the movements of exchange rate returns and Handelsbanken (Graph 4) and Swedbank (Graph 5) stock returns. As seen the exchange rates and the stock returns move overall in the same direction with some more extreme tops and bottoms in the stock return.

Graph 4

Return on Handelsbanken Stock and Exchange rates return

Graph 5

Return on Swedbank Stock and Exchange rates return
Appendix 5

Table 8 shows the obtained market beta from the performed regressions. That is, how the stock returns move in relation to market movements. As seen, all banks have positive betas indicating that from an increase in market, the banks’ stock return is expected to increase. SEB has a pretty high market beta, and an increase in market return by 1% causes stock return to increase by 1.488%. Swedbank has the second highest followed by Nordea and Handelsbanken. All betas are statistically significant at the 5% level.

Table 8 Banks Market Beta

<table>
<thead>
<tr>
<th></th>
<th>Nordea</th>
<th>SEB</th>
<th>Handelsbanken</th>
<th>Swedbank</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_1$</td>
<td>0.264</td>
<td>1.488</td>
<td>0.193</td>
<td>1.415</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000***</td>
<td>0.000***</td>
<td>0.004***</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

Notes: *** denotes the 5% significance level.